The Effect of Theories of Intelligence on Immediate and Delayed JOLs

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A report submitted as a partial requirement for the degree of Bachelor of Psychological Science with Honours in Psychology at the University of Tasmania, 2016

Statement of Sources

I declare that this report is my own original work and that contributions of others have been duly acknowledged.

Signed:__________________________ Date:__13/10/2016____

Caitlin Gleeson

Acknowledgements

To my supervisor, Dr Matthew Palmer, thank you for your support and guidance throughout the year. Thank you for enabling me to be an autonomous learner and answering my continual stream of emails and questions. The time and effort you dedicated to setting up excel spreadsheets to enable easier data analysis was much appreciated.

Thank you to Dr Christine Padgett, Dr Cynthia Honan, and Mr Peter Tranent for your help in recruiting participants. Special thanks to Nicole McCallum from Flinders University for recruiting and running participants through the study. Thank you to Frances Parkes for your assistance with setting up the E-Prime software and answering any questions I had regarding the program.

Thank you to everyone who participated in this study, without you this research would not have been possible. A special thank you to my research partner Terry Purton for sharing data collection and providing invaluable emotional support.

Thank you to my parents for your continual support and encouragement to ensure I achieved my best. Thank you to my mum for always checking in to make sure I was okay and to my dad for telling me there was no point in stressing even though you knew I would anyway.

Thank you to my partner Alex for spending hours editing my thesis and supporting me through everything. Thank you for knowing exactly what to say to relieve my stress and having unwavering faith in me.

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Word Count: 9,917

Abstract

This study investigated the effect of individual's theory of intelligence (TOI) on resolution between judgements of learning (JOLs) and recall. JOLs are predictions of future memory and can differ due to TOIs being more fixed (*entity*) or malleable (*incremental*). Fifty-eight participants (39 females; mean age 24 years) viewed Indonesian-English word pairs providing immediate and delayed JOLs before final recall. Dwecks (1999) Theories of Intelligence Scale –Self form for Adults assessed participants TOI. The results did not support the hypotheses that resolution for immediate JOLs would be better for entity than incremental theorists, and this difference would be smaller for delayed JOLs. Consistent with the delayed JOL effect resolution was found to be higher when JOLs were delayed ($p<.001$). A difficulty x TOI interaction was identified whereby resolution for incremental theorists was highest for moderate and difficult word pairs, while for entity theorists resolution was best for easy pairs ($p=.023$). It was concluded that resolution did not differ between entity and incremental theorists for immediate and delayed JOLs, suggesting there is no inaccuracy in JOLs for incremental theorists. Delayed JOLs, however, were more accurate overall. Further research is necessary to identify if these JOLs affect study behaviour in more ecological settings.

Strategies for improving educational outcomes have been investigated for many years, and are the focus of numerous government agencies (Greenberg, et al., 2003; Tirozzi, & Uro, 1997). Improving educational outcomes is important for society as a whole, but is of special importance for disadvantaged individuals (Gray, & Beresford, 2008; Aronson, Fried, & Good, 2002). Researchers worldwide are interested in the most effective way to improve educational outcomes and therefore provide the best opportunities in life (Sawyer, Miller-Lewis, Searle, Sawyer, & Lynch, 2015; Tarbetsky, Collie, & Martin, 2016). One approach to improving educational outcomes is to consider views of intelligence (Blackwell, Trzesniewski, & Dweck, 2007).

Dwecks implicit theory of intelligence (TOI) describes two views of intelligence that are believed to effect educational outcomes; entity and incremental (Dweck, 1999). Entity theorists view intelligence as fixed and uncontrollable and therefore believe it cannot be increased through effort (Dweck, & Legget, 1988). Incremental theorists, however, believe intelligence is more dynamic and malleable and thus can be improved with effort (Dweck, Chiu, & Hong, 1995). Previous research has concluded that an incremental theory is superior to entity as it leads to positive learning goals, increases in effort, and greater academic achievement (Blackwell, et al., 2007).

The current research therefore aims to further research into TOIs and academic achievement by focusing on individual's judgements of learning (JOLs). JOLs are predictions of future memory and are essential in self-regulated learning (Finn, & Tauber, 2015). Previous research, however, has identified impairments in JOLs due to an incremental view of intelligence (Miele, Finn, & Molden, 2011). These findings were only evident for immediate JOLs and therefore the current study is investigating whether the impairments in immediate JOLs due to an incremental view of intelligence can also be found when delaying JOLs.

Theories of Intelligence

Dwecks implicit TOI describes two views of intelligence, entity and incremental, that has been ascertained to influence motivation, goals, and subsequently achievements (Dweck, 1999). *Entity* theorists view intelligence as a fixed, unchangeable and uncontrollable entity that no amount of effort can change (Dweck, & Legget, 1988). They believe that everyone has a certain level of intelligence that, no matter the effort of persistence, cannot be improved or increased (Dweck, 1999). *Incremental* theorists, conversely, believe intelligence to be more malleable and dynamic, hence enabling it to increase with effort (Dweck, et al., 1995). In comparison to entity theorists they believe that everyone has the ability to increase their intelligence if they invest the right amount of time and effort, but do realise that some individuals will be able to achieve more in life than others (Dweck, 1999).

The identification of these TOIs has led many to believe that entity theorists are more dominant in society, however, previous research states that the amount of entity and incremental theorists is almost equal with as little as twenty percent of individual’s being undecided regarding their views (Dweck, & Molden, 2005). This can therefore cause problems for many individuals with research concluding that incremental theorists are superior due to their ability to achieve more in academic settings, overcome challenges more adequately, and attain overall better outcomes (Blackwell, et al., 2007). This superiority is evidenced clearly in educational settings in which incremental theorists are consistently found to outperform entity theorists (Blackwell, et al., 2007)

TOI and Achievement

A longitudinal study of American children transitioning from middle school to junior high identified the positive effects of an incremental view of intelligence (Blackwell, et al., 2007). Not only were improvements in academic outcomes identified with students who previously held an incremental view, but the researchers were able to teach students to implement an incremental view and thus improve performance (Blackwell, et al., 2007). Through the use of an eight week program they were able to teach individuals who previously held an entity view how to think in an incremental manner (Blackwell, et al., 2007).

After two years of continual research it was identified that having an incremental view of intelligence was positively associated with an increase in motivation, positive learning goals, and beliefs in effort (Blackwell, et al., 2007). While having an incremental view provided positive outcomes, the opposite was true for entity theorists who were outperformed in numerous educational domains (Blackwell, et al., 2007). Interestingly, it was found that incremental theorists not only believed that working hard was integral in achievement, but they were also able to adopt new effort-based strategies to help them overcome setbacks that would otherwise deter entity theorists (Blackwell, et al., 2007). This experiment not only displays the improvements in academic performance due to an incremental view, but also the ability to manipulate an individual's TOI and maintain it over a long period of time (Blackwell, et al., 2007).

Evidence that an incremental view of intelligence promotes better attitudes towards learning and thus improves academic performance has also been established with vulnerable groups (Tarbetsky, et al., 2016; Aronson, et al., 2002; Claro, Paunesku, & Dweck, 2016). Researchers have recently identified a link between an incremental TOI and improvements in academic performance for those from a disadvantaged economic background (Claro, et al., 2016). It was found that those with an incremental TOI that were in the bottom 10th percentile of family incomes had similar test scores to those in the top 80th percentile with an entity view (Claro, et al., 2016). Having an incremental view of intelligence when in a position of disadvantage can improve persistence and goals so that achievement is similar to those with the most advantaged background (Claro, et al., 2016). This displays the positive effect an incremental view can have on the academic performance of those from poverty (Claro, et al., 2016). These results were found at every socioeconomic level with those with an incremental view of intelligence performing significantly better than those with an entity view (Claro, et al., 2016). This signifies the broad range of individuals that an incremental TOI can benefit, and thus changing TOIs can cause substantial improvements for all types of people (Claro, et al., 2016).

Another vulnerable group in which beliefs regarding intelligence have been investigated is African American students (Aronson, et al., 2002). Researchers found that providing just three sessions in which students were taught to view intelligence as malleable (*incremental*) helped to change beliefs regarding intelligence (Aronson, et al., 2002). Those whose view of intelligence had been manipulated (compared to the control group) had more positive beliefs towards school and academic achievement as well as indicating higher grades on subsequent tests (Aronson, et al., 2002). This provides strong evidence for how easily views of intelligence can be changed, with an incremental view of intelligence leading to better attitudes and performance (Aronson, et al., 2002).

A study involving Indigenous (Aboriginal) Australian students also found that an incremental view of intelligence was positively associated with academic outcomes (Tarbetsky, et al., 2016). Although these Indigenous students were more likely to have an entity view and therefore had lower academic results, teaching these students to view intelligence as incremental improved outcomes (Tarbetsky, et al., 2016). The finding that the relationship between Indigenous students and academic achievement occurred via implicit beliefs regarding intelligence displays the positive effects of teaching students to adopt an incremental view (Tarbetsky, et al., 2016). These improvements in academic achievement for incremental theorists in both vulnerable and non-vulnerable groups have been identified as being due to the achievement goals implemented by incremental theorists (Dweck, 1999; Dweck & Molden, 2005).

Achievement Goals

The distinction between achievement goals for entity and incremental theorists is essential in understanding the motivation behind study decisions and persistence when faced with challenges (Dweck, & Legget, 1988). These goals can simply be distinguished as the validation of one's abilities (*performance goals)* and the acquisition of such abilities (*learning goals;* Dweck & Molden, 2005). These goals have been linked separately to entity and incremental views of intelligence (Thompson, & Musket, 2005).

Numerous studies have linked an entity view of intelligence to performance goals whereby individuals seek validation of their intelligence and avoid negative outcomes (Hughes, 2015). Individual's with performance goals (*entity theorists)* have a tendency to be concerned with displaying their competence to others and therefore will not choose challenging tasks as they may result in negative judgements (Thompson, & Musket, 2005). Entity theorists also believe that their academic success or failure is due to external forces (Robins, & Pals, 2002). Not only do they consider their failures as due to insufficient skills and ability, they also believe that their academic success is due to luck rather than adequate abilities (Robins, & Pals, 2002). Incremental theorists, however, tend to possess learning goals in which individual's value improving their skills and learning from challenging tasks (Hughes, 2015). Learning goals (*incremental theorists)* lead individual's to seek out challenging tasks and increase effort so they are able to improve their abilities (Thompson, & Musket, 2005). In comparison to entity theorists, incremental theorists believe that failure at a task is a sign that increased effort is necessary and therefore persist with challenging tasks (Dweck, & Molden, 2005). These differences highlight the relationship between TOI, goals and the coping strategies evoked when faced with challenges (Dweck, 1999).

Those with learning goals (*incremental)* also benefit from having a mastery-oriented approach to challenges while performance goals (*entity)* are connected to a maladaptive helpless approach (Dweck, 1999). Having an entity TOI can raise anxiety regarding academic challenges and failures, which results in defensive and helpless behaviour (Ahmavaara, & Houston, 2007). When faced with difficult challenges, those with a helpless approach tend to have a maladaptive coping response whereby they disengage with the task as they believe no amount of effort will be able to improve their outcomes (Robins, & Pals, 2002). They are inclined to avoid displaying their inadequacy, with studies revealing entity theorists will begin to advocate for their achievements in other areas to cover their present failures (Dweck, 1999). Having such a maladaptive coping response often leads to procrastination with difficult items, poor academic performance and negative beliefs regarding past and future tasks (Dweck, 1999).

A mastery-oriented approach, however, has positive implications as individuals implementing this approach increase effort and persistence when faced with the same difficult tasks (Davis, Burnette, Allison, & Stone, 2011). This approach means incremental theorists have a positive view of challenges which enables them to develop new, more appropriate strategies to overcome setbacks (Robins, & Pals, 2002). Recent evidence has also directly linked an incremental view of intelligence to greater intentions to persist in an educational setting (Renaud-Dubé, Guay, Talbot, Taylor, & Koestner, 2015). This subsequently leads to individual's staying in school for longer periods and thus achieving greater academic outcomes (Renaud-Dubé, et al., 2015). The mastery-oriented approach, overall, provides a more active coping style and thus results in better academic performance and higher self-esteem (Dweck, 1999).

The large distinction between helpless and mastery-oriented approaches brought many researchers to the conclusion that an incremental TOI is superior to an entity TOI (Dweck, 1999; Dweck & Molden, 2005). As an incremental TOI has been found to be associated with intentions to persist and improve performance, it was concluded that recommending an incremental view would be beneficial to students in an educational setting and beyond (Renaud-Dubé, et al., 2015). Having an incremental TOI changed motivation and goals in a positive manner whereby students were more willing to persist with challenges and thus able to achieve better outcomes (Renaud-Dubé, et al., 2015). This therefore enables them to not only improve their skills and intelligence but to also accurately learn content, and achieve consistently higher results than entity theorists in academic settings (Blackwell, et al., 2007). While an incremental view of intelligence, and the associated achievement goals, has been found to result in improved outcomes, there is the belief that TOIs cannot be distinctly categorised as entity or incremental (Thomas, & Sarnecka, 2015).

The Stability of TOI

Researchers have established that most individuals can be separated into an entity or incremental category for research purposes but in more ecological settings TOIs occur on a continuum (Thomas, & Sarnecka, 2015). Recent research has shown that individuals can fall anywhere on the continuum from believing that intelligence is very fixed (*entity*) to very malleable (*incremental*) and anywhere in between (Thomas, & Sarnecka, 2015). It was found that although individual's responses to three main questions regarding their TOIs created two definitive categories, when these views were extended to a broader range of questions views of intelligence were not so distinct (Thomas, & Sarnecka, 2015). Research conducted has therefore concluded that TOIs are indeed not separate and rather, individuals can be more or less entity or incremental depending on the task at hand and the domain being tested (Dweck, & Molden, 2005; Thomas, & Sarnecka, 2015).

Due to individuals TOIs changing depending on the task involved, the stability of such views has been questioned (Robins, & Pals, 2002). This means that although TOIs remain relatively stable over the lifetime, people may not hold the same TOI for all aspects of life (Dweck, et al., 1995). Some may believe, for example, that their math ability is a fixed entity (*entity theorist)* while also believing that their science skills are more malleable (*Incremental theorist;* Dweck, et al., 1995). As TOIs are not stable for all aspects of life, research has been conducted into whether TOIs can be manipulated (Elliot, & Dweck, 1988; Blackwell, et al., 2007). Evidence indicates that the manipulation of such beliefs can occur both in the short term (Miele, & Molden, 2010; Experiment 2) and the long-term (Blackwell, et al., 2007). This has led to the belief that implicit theories are particularly complex as they are both stable, and able to be manipulated at the same time (Dweck, et al., 1995). Long-term manipulation of TOIs may be especially important in educational settings due to the evidence that an incremental TOI leads to positive learning goals, increased persistence and improved academic performance (Blackwell, et al., 2007).

Although numerous studies have identified these advantages to an incremental TOI, more recent research suggests that there may also be notable disadvantages (Miele, & Molden, 2010). Recent evidence proposes that an incremental TOI has the ability to impair metacognitive judgements (Miele, et al., 2011). Metacognition comprises an individual's knowledge and beliefs obtaining to their cognition and includes the monitoring and control of their learning (Son, 2007). Metacognitive judgements in the form of JOLs are believed to differ between entity and incremental theorists due to the cues relied upon (Miele, et al., 2011). It is these differences in the underlying basis of JOLs that is believed to impair the accuracy of metacognitive judgements and subsequently study choices for incremental theorists (Miele, et al., 2011).

Metacognition

Metacognition is essential in educational settings as a determinant of future memory performance and subsequently study behaviours (Metcalfe, & Kornell, 2005). Metacognitive judgements are integral for dictating future behaviour, and therefore their accuracy is of utmost importance (Metcalfe, & Finn, 2008a). Metacognition allows for an individual to make adequate decisions regarding their knowledge of stimuli through the monitoring and control of their learning (Schwartz, & Perfect, 2002). *Monitoring* refers to the processes that allow an individual to reflect on their own cognition while *control* processes enable decisions regarding future behaviour and are based on the information obtained during monitoring (Schwartz, & Perfect, 2002). Control processes are the basis for whether or not individuals decide to continue studying an item, which is often made in the form of an individual's JOL (Tauber, & Rhodes, 2012).

JOLs are predictions of future memory and are essential in determining self-regulated learning (Finn, & Tauber, 2015). JOLs are predominantly measured on a continuum, with high JOLs indicating confidence in one's ability to recall an item and low JOLs signalling very little confidence (Rhodes, & Tauber, 2011). JOLs play a critical role in the allocation of study time, as an accurate JOL enables an individual to study items they do not know rather than spending unnecessary time on stimuli they already adequately remember (Finn, & Tauber, 2015). Research has found that JOLs have a direct effect on individual's study choices independent of previous test performance (Metcalfe, & Finn, 2008b). Due to their influential role in formulating study decisions it is paramount that they be accurate, especially in educational settings (Metcalfe, & Finn, 2008b).

Cue Utilisation View

The underlying basis of JOLs has caused much debate with some researchers claiming JOLs are centred on a direct access approach (Tauber & Rhodes, 2010) while others argue for the cue utilisation view (Koriat, 2008). The direct access approach is based on the idea that the strength of a memory determines the JOL, in which an item with weak strength will be given a low JOL (Tauber, & Rhodes, 2010). The cue utilisation view, however, identifies the importance of the cues that JOLs are determined by, such as intrinsic, extrinsic and mnemonic cues (Koriat, 1997). Intrinsic cues are indicators of whether an item will be difficult or not, while extrinsic cues refer to the circumstances in which learning occurs, such as the ability to practice or study items (Koriat, 1997). According to this perspective, mnemonic cues (those determined by experiences during encoding) are the most integral as they rely on both intrinsic and extrinsic factors (Koriat, 1997). Experiences of encoding, such as ease of processing and retrieval fluency, lead to higher JOLs for items that come to mind more easily (Kelley, & Lindsay, 1993).

It is important, however, to note that cues based on perceived processing fluency are not always correct and therefore can lead to inaccurate JOLs (Koriat, 2008). This has been shown through previous research in which changing the fluency in which a lecture is delivered causes differential effects in JOLs (Carpenter, Wilford, Kornell, & Mullaney, 2013). While participants viewing a fluent lecturer provided higher JOLs, their actual memory performance was no different to those who saw the disfluent lecturer (Carpenter, et al., 2013). This difference in interpretation of processing fluency has led researchers to believe that the resolution of JOLs may be mitigated by views of intelligence (Miele, & Molden, 2010).

JOLs and TOI

Inaccuracy of JOLs is a prominent issue in the allocation of study time and can be due to the cues individuals’ base these judgements on (Carpenter, et al., 2013). The cues used by entity and incremental theorists are derived from the differences in their interpretation of effort expenditure (Dweck, 1999). While entity theorists believe that increased effort is associated with reaching the limits of their ability, incremental theorists believe that the same amount of effort is necessary to master a new skill or learn new stimuli (Blackwell, et al., 2007). These results identify a difference in the way effort is defined and the subsequent heuristics entity and incremental theorists use to differentiate between what they do and do not know (Miele, & Molden, 2010).

Research has shown that JOLs are often based on an “easier is better” heuristic when making decisions regarding what will be remembered (Koriat, 2008). The heuristic is often referred to as easily learned, easily remembered (ELER) whereby JOLs are based on the ease with which something feels to encode, or rather its processing fluency (Miele, et al., 2011). This heuristic is based on the idea that items that are more easily learned will be better remembered in the future (Koriat, 2008). The ELER heuristic has subsequently been found to be associated with an entity TOI (Miele, et al., 2011). Entity theorists believe that effortful processing is a signal that they have reached their maximum capabilities and thus will not be able to learn that stimuli (Miele, & Molden, 2010). This means that as processing fluency decreases and items require more effort expenditure entity theorists will disengage due to their maladaptive helpless approach to challenges (Dweck, 1999). Although entity theorists disengage with difficult tasks their JOLs remain accurate (Miele, et al., 2011).

Entity theorists that adopt the ELER heuristic have been found to provide lower JOLs for items that are difficult and therefore are lower in processing fluency (Miele, et al., 2011). In general this leads to more accurate JOLs as items that are more difficult to process often tend to be more challenging to understand and thus remember (Miele, et al., 2011). Incremental theorists, conversely, provide low JOLs for stimuli with high processing fluency and thus a reversal of the ELER heuristic was identified; the highly engaged, easily remembered (HEER) heuristic (Miele, et al., 2011). Incremental theorists believe that effort expenditure due to difficulty in processing is actually caused by amplified engagement with the task that subsequently leads to better learning (Miele, et al., 2011). Incremental theorists have been found to report higher JOLs for items that are low in processing fluency and therefore harder to encode, due to the increased effort necessary to process such items (Miele, et al., 2011; Miele, & Molden, 2010).

The use of these heuristics is further evident when processing fluency is measured as study time (Miele, & Molden, 2010). The longer entity theorists spend studying an item the less comprehension, and thus lower JOLs, are recounted. This is consistent with the ELER heuristic as processing fluency decreases so do JOLs (Koriat, 2008). The reversal of the ELER heuristics, the HEER heuristic, is also evident in study time with incremental theorists reporting higher comprehension, and therefore higher JOLs, the more time they spent studying items (Miele, & Molden, 2010).

These differences in the underlying basis for effort input between entity and incremental theorists can cause inadequate study choices due to inaccurate JOLs (Dweck, 1999). Research suggests that as perceived fluency decreases entity theorists are able to easily distinguish this material as hard to comprehend as it does not fit with the ELER heuristic (Miele, et al., 2011). Incremental theorists, however, believe that the more highly engaged they are with material the more adequately they would have processed it, which is not always correct (Miele, et al., 2011).

The different underlying heuristics associated with each TOI identifies that contrary to previous research, having an incremental view of intelligence may not always be superior due to insufficient study choices (Miele, et al., 2011). Academic performance and effort may subsequently be affected by these heuristics with both positive and negative outcomes for each TOI (Miele, & Molden, 2010). Namely, entity theorists will find challenging tasks difficult and hence give up (Miele, Son, & Metcalfe, 2013). However, due to their use of the ELER heuristic they will be able to more adequately identify what they have and have not learnt and therefore make better study choices (Miele, et al., 2011). Incremental theorists, conversely, will identify the same difficult tasks as a challenge to overcome and thus preserve for a longer period (Dweck, et al., 1995). They will still, however, have more difficulty in distinguishing which items will be remembered, subsequently causing inaccurate study choices due to their reliance on the HEER heuristic (Miele, et al., 2011).

Previous research identifying impairments in the accuracy of incremental theorists JOLs have relied on immediate JOLs and have not considered the impact of delaying JOLs (Miele, & Molden, 2010; Miele, et al., 2011). An immediate JOL occurs as soon as an item has been studied and relies on the ease of processing (Finn, & Tauber, 2015). Delayed JOLs, however, have been found to be more accurate due to reliance on retrieval fluency (Delayed JOL effect; Nelson, & Dunlosky, 1991).

Delayed JOLs

The accuracy of delayed JOLs arise when there is a delay between an item being studied and the subsequent JOL decision, thus allowing the item to be transferred to long-term memory (Nelson, & Dunlosky, 1991). Immediate and delayed JOLs are differentiated by the information relied upon when making such judgements (Koriat, 1997). Immediate JOLs rely on ease of processing, or the ease with which something feels to encode at the time of processing (Finn, & Tauber, 2015). Immediate JOLs reliance on ease of processing can cause dissociations between what an individual thinks they know and what they actually know (Finn, & Tauber, 2015). As processing fluency can be manipulated (e.g. font clarity), items that are easier to process are not necessarily easier to remember, and therefore a JOL that relies on this may be inaccurate (Miele, & Molden, 2010).

Delayed JOLs, however, rely on retrieval fluency which refers to an actual attempt to recall an item from memory (Pyc, Rawson, & Aschenbrenner, 2014). This enables individuals to more accurately decipher what they do and do not know as it relies on information in long term memory (Rhodes, & Tauber, 2011). Through research Koriat and Ma'ayan (2005) discovered that delayed JOLs are better predictors of an individual's final memory performance than immediate JOLs. More specifically, it was found that a longer delay (215s) in JOLs produced higher accuracy than a shorter delay (60s; Koriat, & Ma'ayan, 2005). Previous research has identified delayed JOLs as more accurate predictors of future memory due to the different cues implemented (Pyc, et al., 2014). Mnemonic cues such as retrieval fluency are used more readily with delayed JOLs as opposed to immediate JOLs, which are consistent with findings from the cue utilisation view (Pyc, et al., 2014).

Further meta-analyses combining more than a decade's worth of research have all identified delayed JOLs as leading to more accurate predictions of future memory performance (Rhodes, & Tauber, 2011). It has been suggested that delayed JOLs, rather than immediate, present a more definitive prediction of final memory performance and therefore should be used more readily (Rhodes, & Tauber, 2011). The increased accuracy of delayed JOLs also enables effective decisions regarding when to cease studying an item and when continuance is necessary (Pyc, et al., 2014).

The Current Study

The current study aimed to further research by Miele and colleagues (2011) on the effect of TOI on JOLs. This was accomplished by examining the differences in resolution of immediate JOLs between entity and incremental theorists and identifying how these might be mitigated by delaying JOLs. This research may have both theoretical and applied implications in the area of metacognition. This research will help to further the knowledge already available regarding the relationship between TOIs and metacognition. Specifically, it will help extend the knowledge already available for immediate JOLs (Miele, et al., 2011) to include delayed JOLs. This will have an impact on the study advice provided to incremental theorists as inaccurate JOLs may lead to inadequate study choices (Finn, & Tauber, 2015). These findings may help to optimise study choices for incremental theorists so they are better able to decipher what stimuli requires further study and what does not. These study choices rely on the cue implemented, which have been identified to differentiate depending on TOIs (Miele, et al., 2011).

Through previous research it was identified that entity theorists rely on the ELER heuristic when making immediate JOLs while incremental theorists rely on the HEER heuristic (Miele, et al., 2011). These differences enable entity theorists to provide more accurate predictions of future memory while also displaying little motivation to persist with difficult stimuli (Miele, et al., 2011). Incremental theorists, meanwhile, supply inaccurate JOLs but have more adaptive responses to challenges (Miele, et al., 2011). Due to this, it was hypothesised that when providing an immediate JOL entity theorists will have better resolution between JOLs and final test performance than incremental theorists.

While immediate JOLs are based on ease of processing (and thus the ELER and HEER heuristics); delayed JOLs rely predominantly on retrieval fluency (Finn, & Tauber, 2015). This reliance on retrieval fluency may mean that entity and incremental theorists do not rely on their usual heuristics when making delayed JOLs. Thus, the impairment in accuracy of JOLs for incremental theorists when making immediate JOLs should decrease when providing delayed JOLs. It was, therefore, hypothesised that the difference in resolution between entity and incremental theorists will be smaller for delayed than immediate JOLs.

Method

Participants

The sample consisted of 58 participants with 39 females and 19 males. Participants ranged in age from 18 to 40 years old (*M*=24.41, *SD*=5.97). Participants were recruited through the University of Tasmania and Flinders University, receiving either course credit or $20 for their time. Participants who were not fluent in English or were fluent in Indonesian were excluded from participating. Nine participants had previously studied Indonesian at some point in their life and their data was viewed for any discrepancies regarding normal responses to the research materials. As these participants had not studied Indonesian recently and no differences were found, they were thus included in the data set.

Procedure and Materials

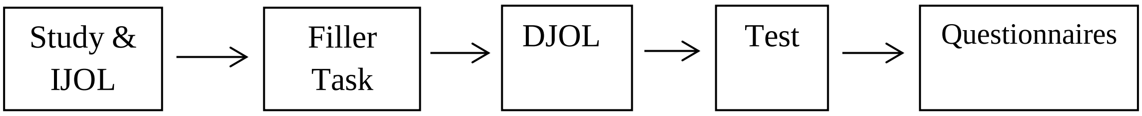

Figure 1: Procedure of the Study

The current study was conducted on a computer using E-prime 2.0 software. Participants first provided informed consent (see Appendix B and C) before being presented with instructions via the computer. Participants were first presented with the word pairs one at a time on the screen and asked to learn each pair as they would need to rate their confidence later (see Figure 1). Participants were informed that they would only be able to view each pair once. Study time was self-paced and therefore participants could view the word pair for as long as necessary before pressing the “space bar” to move to the next screen. Participants were then presented with the question “how likely is it that you will recall the English word when presented with the Indonesian word?” and asked to provide a JOL. JOLs were made on a scale from 0 to 100 by typing the answer and pressing the “space bar” to continue. This was repeated for all word pairs which were presented in a random order for each participant.

Word pairs; Fifty-four Indonesian-English word pairs were taken from an already existing list (Kornell, & Son, 2009). The word pairs consisted equally of high-fluency (e.g. *taxi* – *taksi*), medium-fluency (e.g. *school* – *sekolah*) and low-fluency pairs (e.g. *theatre* – *sandiwara*) that had been normed through previous research (Kornell, & Son, 2009). Word pairs were split into difficulty levels using correlations of r <.29 (low-fluency), r=.33-.60 (medium-fluency) and r=.62-1.0 (high-fluency; See Appendix E).

Judgements of Learning; Judgements of learning were measured on a scale from 0 (completely uncertain) to 100 (completely certain) for both the immediate and delayed judgements.

Once participants had provided their JOLs they completed the filler task (see figure 1). The filler task consisted of mathematical problems with participants completing as many as they could in two minutes. The amount of mathematical problems seen, therefore, differed for each participant. Each mathematical problem appeared on the screen and participants could type the answer or press the "space bar" to continue if they did not know the correct response.

Filler task; The filler task consisted of mathematical problems of random difficulty (e.g. 4x8-12) which were presented on the screen for a total of two minutes.

Following the filler task participants were again presented with the same fifty-four word pairs in a random order. Participants were presented with the Indonesian word only and asked to provide a delayed JOL on the same screen (see Figure 1) in response to the question "how likely is it that you can recall the second word from this pair?"

Following this, participants completed the final recall test (see Figure 1). Participants were again provided with the Indonesian word from each pair in a random order and asked to supply the matching English word by typing the answer in the space provided. Participants were instructed that if they did not know the matching word they could leave the space blank and continue. Final recall performance was marked for accuracy by two independent raters, with any disagreements resolved through discussion.

Once participants had completed the recall test the computer section was finished. Participants were then given a piece of paper containing the Theory of Intelligence Questionnaire and language history questions that they filled out in their own time (see Figure 1). In conclusion participants were asked if they had any questions and thanked for their time.

Theories of Intelligence; Participants theory of intelligence was measured using Dweck's (1999) Theories of Intelligence Scale – Self Form for Adults. The questionnaire consisted of eight items in which participants indicated how much they agreed or disagreed with each statement from 1 (strongly agree) to 6 (strongly disagree). The items consisted of four questions pertaining to an incremental view of intelligence (*e.g.no matter who you are*, *you can significantly change your intelligence*) and four questions concerning an entity view (*e.g. your intelligence is something about you that you can't change very much*).

Language history; Participants answered three questions pertaining to their history with the foreign language used (see Appendix F).

Design

The study implemented a 2 (theory: incremental, entity) x 2 (time: immediate, delayed) x 3 (difficulty: easy, moderate, difficult) mixed design. TOI was measured between subjects, with time and difficulty measured within subjects. The dependent measure was judgements of learning accuracy as measured through resolution.

Judgements of Learning Accuracy

There are numerous ways to measure the accuracy of JOLs, with one method being resolution (Fleming, & Lau, 2014). Resolution refers to how well an individual can differentiate items that will be remembered from those that will not (Tauber, & Rhodes, 2010). Resolution is believed to be a superior measurement of metacognitive accuracy as it is not susceptible to the biases other measures are (Fleming, & Lau, 2014). Other measures such as gamma correlations are vulnerable to response bias, whereby an individual's tendency to provide high or low confidence ratings for all items subsequently alters their overall accuracy (Fleming, & Lau, 2014). Resolution was calculated using the Adjusted Normalised Discrimination Index (ANDI; Yaniv, Yates, & Smith, 1991). ANDI provides scores between 0 and 1, with higher scores equalling better resolution and therefore a more adequate ability to decipher what will and will not be remembered (Yaniv, et al., 1991).

Results

Preliminary Analyses and Data Cleaning

TOI was split into two groups, entity and incremental, for the purpose of analyses (Dweck, et al., 1995; Miele, & Molden, 2010). Scoring of the TOI questionnaire was based on procedures implemented in previous research (Miele, & Molden, 2010). Items on the questionnaire regarding incremental views were reversed and the sum of these items along with entity items were calculated so scores ranged from 8 (most entity) to 48 (most incremental). A median split of 35 was identified with all scores on or above the median categorised as relatively more incremental, and those with scores below the median as relatively more entity.

All analyses were conducted with TOI as a dichotomous moderator variable (through ANOVA) and as a continuous moderator variable (ANCOVA). In all cases except one, the same pattern of results was produced and therefore the ANOVA is reported for ease of explanation of the results. In the one case where the results differed, ANCOVA is reported to fully replicate the findings of Miele and colleagues (2011). Any significant main effects were followed up with Bonferroni adjusted pairwise comparisons.

In the case of a violation of sphericity, evidenced by a significant Mauchly's test, a Greenhouse-Geisser correction was implemented. The assumption of homogeneity of variance has been met for all analyses (indicated by a non-significant Levene's test) unless otherwise stated. Skewed data was identified for resolution (positive and negative skew), study time (positive skew) and accuracy (positive and negative skew). Data with negative skews were reflected and all data was transformed using the natural logarithm. These log transformations did not change the results and thus untransformed results are provided.

Metacognitive Accuracy (Resolution)

Analyses of resolution was conducted using a 2(TOI) x 2(Time) x 3(Difficulty) mixed ANOVA. It is important to note that due to the measure of resolution used (ANDI) seventeen participants were excluded from the analysis. ANDI requires at least one correct and incorrect answer to be calculated, and as participants could not meet this requirement for difficult word pairs, ANDI could not be computed. These analyses did not support the hypotheses that resolution would differ between immediate and delayed JOLs dependent on TOI. Levene's test identified that the assumption of homogeneity of variance was violated for immediate JOLs for easy ($F(1,39) = 4.25$, $p = .046$) and difficult word pairs ($F(1,39) = 27.53$, $p < .001$), as well as for delayed JOLs for difficult word pairs ($F(1,39) = 7.46$, $p = .009$). As ANOVA is a fairly robust test the unadjusted results are reported below, but should be interpreted with some caution (Field, 2013).

There was a non-significant effect of TOI group on resolution (F(1,39)= 2.13, p=.153, d=.45) indicating that overall resolution did not differ between entity and incremental theorists. There was, however, a significant main effect of time on resolution with a large effect size, F(1,39)= 76.82, p<.001, d=1.05. The significant main effect of time identifies that resolution was higher for delayed JOLs (M=0.628, SD=0.17) than for immediate JOLs (M=0.291, SD=0.17).

The advantages of delaying JOLs did not differ between those with a relatively entity view and those with a relatively incremental TOI. This was evidenced by the non-significant time x TOI interaction, F(1,39)= 1.80, p=.188, η^2_p=.044. There was also a small non-significant main effect of difficulty which suggests that the difficulty of word pairs had little impact on resolution, F(2,78)= .109, p=.897, η^2_p=.003.

There was however, a significant medium sized difficulty x TOI interaction, F(2,78)= 3.98, p=.023, η^2_p=.093. This significant interaction was followed up with measures of effect size to determine the difference between entity and incremental theorists at each level of difficulty. A small to moderate effect size was found between entity and incremental theorists for easy words (d=0.48) and moderate word pairs (d=0.36). A moderate to large effect size (d=0.76), however, was identified between entity and incremental theorists for difficult word pairs. Table 1 contains descriptive statistics for entity and incremental theorists at each level of difficulty. Overall, these results reveal that entity theorists have better resolution when word pairs are easier, but incremental theorists’ resolution is higher when word pairs are

Table 1

Resolution between JOLs and Recall Performance for Entity and Incremental groups

	Entity			Incremental		
Difficulty	n	M(SD)	95% CI	n	M(SD)	95% CI
Easy (IJOL)	20	.274(.363)	[.139, .409]	21	.215(.221)	[.084, .347]
Easy (DJOL)	20	.732(.300)	[.602, .862]	21	.595(.275)	[.468, .722]
Moderate(IJOL)	20	.283(.342)	[.139, .426]	21	.355(.293)	[.214, .495]
Moderate (DJOL)	20	.581(.261)	[.456, .705]	21	.677(.288)	[.555, .798]
Difficult (IJOL)	20	.15(.179)	[-.001, .303]	21	.47(.436)	[.323, .619]
Difficult (DJOL)	20	.56(.323)	[.383, .735]	21	.62(.444)	[.453, .797]

Note: CI= Confidence Interval, IJOL= Immediate Judgement of Learning, DJOL = Delayed Judgement of Learning.

both moderately difficult and difficult.

Analysis of the effect of time x difficulty interaction on resolution, $F(2,78)= 1.09$, $p=.341$, $\eta^2_p=.027$, and the effect of time x difficulty x TOI interaction on resolution were both non-significant, small effects, $F(2,78)= 1.03$, $p=.364$, $\eta^2_p=.026$. These results display that the difficulty x TOI interaction did not vary significantly depending on whether JOLs were immediate or delayed. It also shows that resolution for easy, moderate and difficult word pairs do not differ when JOLs are immediate or delayed.

Study Time

Analyses of study time were conducted using a 2 (TOI) x 3(Difficulty) mixed

ANOVA. Analysis confirmed the manipulation of word pair difficulty with a significant main effect, $F(1.3, 72.2) = 34.88$, $p < .001$, $\eta^2_p = .384$, following a Greenhouse-Geisser correction. Table 2 contains descriptive statistics for entity and incremental theorists. Contrasts revealed that difficult word pairs were studied for a

Table 2

Study Time (in milliseconds) for Entity and Incremental Groups

	Entity			Incremental		
Difficulty	n	M(SD)	95% CI	n	M(SD)	95% CI
Easy	27	3908.97 (1861.22)	[3163.97, 4653.97]	31	4126.49 (1992.11)	[3431.21, 4821.76]
Moderate	27	6232.06 (4177.94)	[4912.54, 7551.58]	31	5391.29 (2596.07)	[4159.85, 6622.75]
Difficult	27	7345.63 (5805.45)	[5661.74, 9029.53]	31	6222.66 (2530.28)	[4651.16, 7794.17]

significantly longer time than easy word pairs, $F(1,56) = 39.07$, $p < .001$, $d = 0.65$, and moderate word pairs, $F(1,56) = 15.53$, $p < .001$, $d = 0.22$. This pattern was identified regardless of TOI as indicated by a non-significant difficulty x TOI interaction, $F(1.3, 72.2) = 2.21$, $p = .114$, $\eta^2_p = .038$, following a Greenhouse-Geisser correction.

Study Time and JOLs

Analyses were conducted to examine the relationship between study time and

JOLs to identify whether JOLs decrease with longer study time and whether this varies between incremental and entity theorists. A correlation analysis found a weak to moderate negative correlation between study time and immediate JOLs (*r* (n=58)= -.242, 95% CI[-.305, -.179]) and a weak negative correlation between study time and delayed JOLs (*r* (n=58)= -.184, 95% CI[-.233, -.136]). This demonstrates that as study time increases, participants JOLs decrease.

Bivariate correlational analyses were conducted between the variables of TOI score and the JOLs x study time correlation. It was found that there was a non-significant correlation between the immediate JOLs x study time correlation and TOI score, *r* (n=58)= -.15, *p*=.26. There was also a non-significant correlation for delayed JOLs, *r* (n=58)= -.07, *p*=.61. This shows that the correlations between both sets of JOLs and study time did not differ depending on whether participants have a relatively incremental or entity TOI score.

Accuracy

Analyses of accuracy were conducted using an ANCOVA, with TOI score as a covariate and difficulty as an independent variable. Analysis of accuracy confirmed significant differences in the amount of correct recall responses dependent on difficulty level through a significant main effect, $F(2,112)= 40.19$, $p<.001$, $\eta^2_p=.42$. Table 3 contains descriptive statistics for each level of difficulty. Contrasts revealed that accuracy was significantly higher for easy than moderate pairs, $F(1,56)= 47.77$, $p<.001$, $\eta^2_p=.46$, but there was no significant difference in accuracy between moderate and difficult word pairs, $F(1,56)= 3.35$, $p=.07$, $\eta^2_p=.06$. There was also no significant interaction between difficulty and TOI score, meaning that the effect of difficulty on accuracy did not differ with TOI score, $F(2,112)= .197$, $p=.821$,

Table 3

Percentage of Correct Recall Responses

Difficulty	M(SD)	95%CI
Easy	.755(.123)	[.725, .785]
Moderate	.270(.142)	[.233, .306]
Difficulty	.104(.130)	[.072, .137]

η^2_p=.004. There was, however, a significant effect of TOI score on accuracy, $F(1,56)= 9.63$, p=.003, η^2_p=.147, which displays that as TOI scores increase (participants TOI is more incremental) overall accuracy decreases (r= -.39, p=.003).

Discussion

The results of the current study did not support the hypothesis that when providing immediate JOLs entity theorists will have better resolution between JOLs and final recall performance than incremental theorists. The hypothesis that the differences in resolution between entity and incremental theorists will be smaller for delayed than immediate JOLs was also not supported. While these results were not found in the current study, differences were identified between resolution for immediate and delayed JOLs.

Resolution between JOLs and final recall performance was higher for delayed JOLs than immediate JOLs, which supports the delayed JOL effect. The delayed JOL effect refers to the increase in accuracy of JOLs when a delay occurs between an item being studied and the subsequent JOL decision (Nelson, & Dunlosky, 1991). Due to delayed JOLs reliance on retrieval fluency rather than processing fluency (as immediate JOLs do) resolution was higher for delayed JOLs (Pyc, et al., 2014). This means that when participants were shown the cue word after a delay they were able to make an attempt to retrieve the matching English word from memory, and thus rely on this more accurate cue when providing their delayed JOL.

These findings can have both theoretical and practical implications in terms of students future study behaviour. The results display that any impairments in immediate JOLs dissipate when they are delayed. This demonstrates that allowing a break between stimuli being presented and JOLs being made reduces reliance on processing fluency and thus increases accuracy. Accurate delayed JOLs have a positive impact on self-regulated learning as they lead to more effective study choices (Metcalfe, & Finn, 2008b) and subsequently better academic performance. Therefore, implementing educational programs to teach students about the benefits of a delayed JOL, in which they attempt to retrieve stimuli to be remembered, may help to improve self-regulated learning.

These improvements in resolution identified with delayed JOLs were not impacted by TOI, thus suggesting that when making JOLs entity and incremental theorists were implementing similar heuristics. Due to this, incremental and entity theorists should be able to make similar, accurate study choices to increase their academic performance. It is therefore suggested that even if incremental theorists do implement the HEER heuristic found in previous research when making immediate JOLs (Miele, et al., 2011), this may not impact their study choices as they are able to make accurate delayed JOLs.

Although TOI did not impact immediate and delayed JOLs differently, there was an effect of TOI on resolution at different levels of difficulty. Incremental theorists were found to better distinguish what they do and do not know when items were more difficult, whereas entity theorists had higher resolution for easy word pairs. The results for incremental theorists are consistent with the ELER heuristic as it is believed that the harder something feels to encode, the easier it is to identify those items as being unlikely to be recalled (Koriat, 2008). These findings are unexpected as previous research linked incremental views with the HEER heuristic not ELER (Miele, et al., 2011). Miele and colleagues (2011) distinctly linked the ELER heuristic to entity theorists and thus it was believed they would be able to more accurately decide what they did and did not know for more difficult words as they do not fit the ELER heuristic. This, however, was not found in the current study and may have been due to inaccurate JOLs on the part of entity theorists. It is probable that entity theorists were unable to differentiate which of the moderate and difficult words would be remembered and which ones definitely would not, causing a decrease in resolution for those word pairs.

Study time

The results regarding study time confirm the effectiveness of the manipulation of difficulty, with difficult word pairs studied for the longest amount of time, followed by moderate and easy word pairs. This is consistent with previous research as things that are more difficult, require more effortful processing and therefore will need to be studied for longer periods to acquire adequate knowledge (Miele, & Molden, 2010). Study time, however, did not differ significantly between entity and incremental theorists. While previous research linked higher accuracy for entity theorists with their increased study time (Miele, et al., 2011); these findings could not be replicated in the current study. This means that at each level of difficulty, entity and incremental theorists studied word pairs for similar amounts of time.

As entity and incremental theorists spent similar amounts of time studying all word pairs it would be expected that their accuracy would be comparable. This is not the case in the current study with entity theorists overall accuracy being higher. Previous research has continually identified incremental theorists as outperforming entity (Blackwell, et al., 2007), which suggests another factor may be affecting performance between immediate recall and later performance. Perseverance with studying may be this factor. The effects of study behaviour would need to be further investigated to identify if entity and incremental theorists continue to study items in a similar manner over a period of time.

Research regarding achievement goals and approaches to setbacks suggest that entity and incremental theorists will not study stimuli in in the same manner (Thompson & Musket, 2005; Robins & Pals, 2002). Previous research has continually found that incremental theorists outperform entity theorists in academic settings due to their mastery-oriented approach and learning goals which lead to increased persistence and motivation (Thompson, & Musket, 2005). While incremental theorists believe that effort expenditure is necessary to increase their performance, entity theorists' belief that they cannot improve their outcomes causes them to disengage with difficult tasks (Robins, & Pals, 2002). These differences may cause incremental theorists to spend more time and effort studying stimuli over a longer period of time which results in better academic performance compared to entity theorists.

Study Time and JOLs

The results regarding study time and JOLs identified differential effects based on the type of JOL made. The differences in the strength of relationship between study time and JOLs dependent on whether the JOL was immediate or delayed identifies the influence of heuristics used. The stronger relationship between immediate JOLs and study time is consistent with the ELER heuristic; as processing fluency decreases and more effortful processing is necessary, study time increases (Koriat, 2008). These increases in study time are reflected in lowered JOLs as individuals believe that the longer items are studied for, the less likely they are to be remembered (Miele, & Molden, 2010). Study time does not have as large an impact on delayed JOLs as they do not solely depend on processing fluency and rather rely on retrieval fluency (Pyc, et al., 2014). Instead, participants made an actual attempt to retrieve the item from memory and largely based their delayed JOLs on that attempt (Nelson & Dunlosky, 1991).

The relationship between JOLs and study time did not differ between entity and incremental theorists and thus suggests that both TOIs are implementing the ELER heuristic when making immediate JOLs. As discussed earlier, this is inconsistent with previous studies whereby an incremental TOI was linked to the HEER heuristic (Miele, et al., 2011). Miele and colleagues (2011) identified the connection between ELER and an entity TOI due to the negative correlation between study time and JOLs and the HEER heuristic for incremental theorists through a positive study time/JOL correlation. The current study found a negative correlation between study time and JOLs for both TOIs, thus suggesting that both incremental and entity theorists were implementing the ELER heuristic. This is not to say that previous research identifying the HEER heuristic for incremental theorists is incorrect, but rather these results were unable to be replicated. Further research, therefore, is necessary to identify whether the HEER heuristic can be identified in numerous samples as has been done with ELER (Koriat, 2008; Koriate & Ma'ayan, 2005; Miele & Molden, 2010).

Accuracy

The significant effect of difficulty on accuracy acts as a manipulation check for word pair difficulty, which has been shown with the current stimuli previously (Miele, et al., 2011). It was found that the higher the TOI score and therefore the more incremental participants viewed their intelligence as, the lower their overall accuracy was which also replicates Miele and colleagues (2011) research. This means that the more an individual viewed their intelligence as relatively entity, the more accurate their recall responses were. Previous research linked higher accuracy to entity theorists increased study time, but as this was not identified in the current research there may be other factors involved. Namely, that entity theorist's may have been able to recognise which word pairs would not be remembered and therefore exert more effort in remembering word pairs they knew they could remember. In contrast incremental theorists may have evenly spread their effort on all word pairs and therefore not have been able to remember as many word pairs overall.

Implications

The results from the current study have both theoretical and practical implications, namely for the implementation of programs in educational settings endorsing incremental views. The results from this study further the existing metacognitive literature, particularly by extending research to link TOIs with delayed JOLs. The current study displays that when providing delayed JOLs those with a relatively entity and a relatively incremental view have increased resolution. Thus any impairment in immediate JOLs dissolves when they are delayed.

Overall the results imply that entity and incremental theorists may be implementing similar cues when providing both immediate and delayed JOLs. This may be due to the highly incremental sample or a limited existence of the HEER heuristic. Most participants scored relatively high on the TOI scale meaning that even those classified as entity were relatively incremental, and this is discussed as a limitation. In terms of heuristics, years of research culminated in the development of the ELER heuristic (Koriat, & Ma'ayan, 2005; Koriat, 2008), while the HEER heuristic was only recently identified and therefore may not exist in all research samples (Miele, et al., 2011).

The inability to identify the HEER heuristic in the current study has positive implications for the endorsement of an incremental TOI. Previous research has been concerned that the inaccuracies caused by the HEER heuristic may result in insufficient study choices by incremental theorists (Miele, & Molden, 2010). In the absence of the HEER heuristic incremental theorists, as seen in the current study, have resolution between JOLs and final recall performance that is comparable, if not better than entity theorists. Due to this, programs endorsing an incremental TOI in educational settings may be implemented without the concern of inaccurate study choices suggested by Miele and colleagues results (2011). In Australia this is especially important in the context of the gap in academic achievement between Indigenous and non-Indigenous Australians (Tarbetsky, et al., 2016). Enabling schools to implement programs endorsing incremental views have already proven to be effective (Aronson, et al., 2002; Blackwell, et al., 2007; Tarbetsky, et al., 2016) and the results from this study suggest that there is little concern for inaccurate study choices. This is due to the absence of the HEER heuristic and the increase in accuracy by delaying JOLs.

The HEER heuristic is believed to lead to inaccurate immediate JOLs which can negatively impact incremental theorists study behaviour (Miele, & Molden, 2010). Informing incremental theorists of these inaccuracies and teaching them to more easily identify items to be restudied would be beneficial. Although this HEER heuristic was not identified in the current study, previous research in which the HEER heuristic was identified suggested that it may lead to poor study choices (Miele, & Molden, 2010). These inferior study choices may not lead to poor performance in the long term due to the achievement goals and approaches to challenges that incremental theorists implement. It is suggested that it may not be JOL accuracy that leads to improved achievement in the long term, but rather it may be effort expenditure. As both entity and incremental theorists had similar levels of resolution and study time in the current research, it is proposed that there are other factors effecting academic performance in educational settings.

While previous research identified more accurate JOLs for entity theorists, it is believed that their lack of motivation and reluctance to exert effort that causes their academic performance to be lowered (Dweck, 1999). Entity theorists believe that there is very little they can do to improve their intelligence and therefore disengage with tasks that are difficult (Robins, & Pals, 2002). In comparison, incremental theorists desire to learn and therefore belief that effort expenditure is necessary improves their performance above and beyond entity theorists (Hughes, 2015). It would, therefore, be important to investigate whether the differences in immediate JOLs identified by Miele and colleagues (2011) result in differential study behaviours. It is suggested that future research provide participants with the opportunity to study items after reporting JOLs to identify if there are differences in what, and how long, these items are studied between incremental and entity theorists. This research would help to identify whether inaccurate JOLs affect study choices and subsequent performance, or rather if motivation and effort expenditure are more important in this process.

These studies may also benefit from focusing on different types of JOLs. Previous research has identified that metacognitive accuracy can change dependent on the type of JOL made (Hanczakowski, Zawadzka, Pasek, & Higham, 2013). It is believed that binary judgements (yes/no) can overcome some of the inaccuracies found when JOLs are made on a continuous scale (Hanczakowski, et al., 2013). It is therefore suggested that future research also implement a binary judgement system to determine whether the current findings vary depending on the type of JOL made.

Limitations

The inconsistencies between the current study and previous research may have occurred for numerous reasons. Firstly, the sample was highly incremental with a median score of thirty-five. Due to this, those who were categorised as more entity may have been behaving and implementing heuristics similar to incremental theorists, causing there to be no difference between the two groups in many of the analyses. The highly incremental sample may have been due to the convenience sample adopted. It has been suggested that having an entity view, whereby outcomes cannot be improved, may be very unattractive to young people, especially those furthering their education (Hughes, 2015). The sample consisted largely of university students and therefore may not have been representative of the wider population which is believed to be split almost evenly between entity and incremental theorists (Dweck, & Molden, 2005).

The highly incremental sample may have also been impacted by the version of Dwecks TOI scale used (1999). Although the eight item Theories of Intelligence Scale – Self Form for Adults is implemented often, there is evidence that focusing on entity items only may provide a more accurate reflection of individuals' views (Dweck, et al., 1995). It is believed that the incremental items included can be highly compelling and therefore individuals may agree with them even if they do not reflect their true beliefs (Dweck, et al., 1995). Providing entity items only can cause concern of its own, namely due to disagreement with entity items not necessarily translating to agreement with incremental items (Dweck, et al., 1995). It may be important to replicate the current study with a version of the scale which includes entity items only to identify whether this provides a more even split between the two TOIs.

More recent research has also argued that the wording of the scale is assessing general views of intelligence rather than an individual's beliefs regarding their own intelligence (De Castella, & Byrne, 2015). De Castella and Byrne (2015) suggested that individuals may hold different beliefs regarding their own intelligence and the intelligence of others. Due to this, a scale that assesses more personalised views was developed (De Castella, & Byrne, 2015). This new scale combined with Dwecks (1999) original scale explained further variance in academic performance and goal approaches than the original scale alone (De Castella, & Byrne, 2015). Therefore, it may be important to assess both general and more personalised beliefs regarding intelligence in future research to ensure variance in academic performance and goals are more adequately explained (De Castella, & Byrne, 2015).

A further limitation of the study is due to the smaller sample analysed for the resolution between JOLs and final recall performance. Seventeen participants had to be excluded from the analysis due to the inability for an ANDI score to be calculated. Although this analysis was conducted with reduced participants, group sizes for TOIs were still very similar (Incremental=21, Entity=20). Due to this, the smaller sample size was still able to provide informative results for interpretation. Future research, however, may benefit from collapsing the moderate and difficult word pairs into one group to be compared with easy word pairs to avoid losing a large amount of participants.

Conclusion

In conclusion, the hypotheses were not supported and TOI had no significant effect on resolution when JOLs were made both immediately and after a delay. Entity and incremental theorists had comparable resolution for both immediate and delayed JOLs suggesting they may have been relying on similar cues when making these JOLs. Resolution, however, did differ between entity and incremental theorists due to the difficulty of word pairs. Incremental theorists were better able to distinguish which items would and would not be recalled for the more difficult pairs, while entity theorists' resolution was higher for easy word pairs. These results identified that incremental theorists may be relying on the ELER heuristic rather than the HEER heuristic found in previous research (Miele, et al., 2011).

The current study did not identify the HEER heuristic and therefore there was no impairment in JOL accuracy for incremental theorists. Based on these results the concerns raised by Miele and colleagues (2011) regarding incremental theorists insufficient study choices are not warranted. It is therefore believed that educational programs endorsing a more incremental TOI would be beneficial to students. Incremental theorists have been found to continually have more adaptive responses to challenges, positive learning goals, and overall improved academic outcomes (Blackwell, et al., 2007). Educational programs endorsing incremental views, therefore, may lead to increased academic performance (Renaud-Dubé, et al., 2015), without the apprehension regarding inaccurate JOLs.

The current study also identified the delayed JOL effect (Nelson, & Dunlosky, 1991) whereby entity and incremental theorists' resolution was significantly higher for delayed JOLs. The impairments identified when participants provided immediate JOLs dissipated when they were delayed. Therefore, implementing educational programs to also teach students about the benefits of a delayed JOL may help to improve self-regulated learning.

Further research, however, is necessary to identify the accuracy of immediate and delayed JOLs in more ecological settings. It would be important to investigate how these JOLs effect subsequent study choices for incremental and entity theorists. It is suggested that this research focus on what, and for how long incremental and entity theorists study items over a longer period of time.

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Appendices

Appendix A: Ethics Approval Letter

Dear Dr Palmer

Ethics Ref: H0012660
Title: Confidence in memory

This email is to confirm that the following amendment was approved by the Chair of the Tasmania Social Sciences Human Research Ethics Committee on 17/5/2016:

- Addition of researchers Prof Andrew Heathcote, Dr Nicole McCallum, Ms Frances Parkes, and Dr Matthew Gretton.
- Addition of student researchers Valera Griffin, Laura Brumby, Terry Purton, and Caitlin Gleeson.
- Addition of Theories of Intelligence Questionnaire.
- Extension of data collection for a further three years.
- Revised Information Sheet for Participants.

All committees operating under the Human Research Ethics Committee (Tasmania) Network are registered and required to comply with the National Statement on Ethical Conduct in Human Research (NHMRC 2007, updated May 2015).

This email constitutes official approval. If your circumstances require a formal letter of amendment approval, please let us know.

Should you have any queries please do not hesitate to contact me.

Kind regards
Katherine

Katherine Shaw
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UNIVERSITY of TASMANIA
CRICOS 00586B

Appendix B: Information Sheet

Locked Bag 1342 Launceston

Tasmania 7250 Australia

Phone (03) 6324 3004 Fax (03) 6324 3168

matthew.palmer@utas.edu.au

Judgements of Learning and Memory

Information Sheet for Participants

1. Invitation

We would like to invite you to participate in a psychology experiment about judgements of learning and memory. The experiment is being conducted in partial fulfillment of an honours degree, by University of Tasmania students Caitlin Gleeson and Terry Purton under the supervision of Dr. Matthew Palmer of the Division of Psychology at the University of Tasmania.

2. What is the purpose of this study?

The experiment is investigating factors that affect people's memory for English/foreign language word pairs.

3. Why have I been invited to participate?

For this experiment, we are looking for people aged 18 years or more who have normal or corrected to normal vision (i.e., glasses or contact lenses are fine).

Participation in this study is voluntary – you are entirely free to choose to participate or not, and there will be no consequences if you decide not to participate. If you do participate, any information you provide will be anonymous and no participants in the experiment will be individually identifiable.

4. What will I be asked to do?

Participation would require approximately 1 hour of your time on only one occasion and would take place in a room in the Psychology building on the UTAS campus. The experiment involves viewing a series of word pairs and then answering some questions about them. Participants will also be asked to complete a brief questionnaire about themselves.

5. Are there any possible benefits from participation in this study?

The results of this experiment will help us to understand what factors affect people's memory for a variety of items and events. This information will be useful, for example, in developing better ways to present information in classes. You would be reimbursed for your time with a payment of $20 or 1 hour of research credit.

6. Are there any possible risks from participation in this study?

There are no foreseeable risks associated with participating in this study.

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7. What if I change my mind during or after the study?

That's fine - you are free to withdraw from the study at any time, and without providing an explanation. If you choose to withdraw during the study, your responses will be destroyed. If you complete the study, you will not be able to withdraw your data because it will be stored in anonymous form (and so we will not be able to identify which responses are yours).

8. What will happen to the information when this study is over?

The data from this study will be kept in secure storage on the University of Tasmania premises for a period of five years after any publications (e.g., in academic journals) that involve the data. After this period, the data will be archived. Only the researcher will have access to the raw data.

The data will be stored anonymously. All responses will be anonymous and no identifying information will be collected from participants.

9. How will the results of the study be published?

The results of the study will be published in an academic journal. Once the study has been completed, you will be able to access the results by visiting the website below:

http://www.utas.edu.au/psychology/research/research-project-reports

No individual participants will be identifiable in the publication of the results.

10. What if I have questions about this study?

If you have any questions about this study, please feel free to contact us via phone on (03) 6324 3004 (Matthew Palmer) or by email: matthew.palmer@utas.edu.au or cl0@utas.edu.au or tpurton@utas.edu.au

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number H0012660.

This information sheet is for you to keep. If you would like to participate in this study, please ask the researcher for a Consent Form to complete.

Thank you for your attention - your time is very much appreciated!

Appendix C: Consent Form

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Judgements of Learning and Memory

Participant Consent Form

1. I agree to take part in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves viewing a series of word pairs and answering questions about them.
5. I understand that participation involves no foreseeable risks.
6. I understand that all research data will be securely stored on the University of Tasmania premises for five years from the publication of the study results, and will then be destroyed unless I give permission for my data to be archived.

   I agree to have my study data archived. (Note that your data will be stored anonymously.)

   Yes ☐ No ☐
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the researchers will maintain confidentiality and that any information I supply to the researcher will be used only for the purposes of the research.
9. I understand that the results of the study will be published so that I cannot be identified as a participant.
10. I understand that my participation is voluntary and that I may withdraw at any time without any effect.

    I understand that I will not be able to withdraw my data after completing the experiment as my data will be anonymous.

Participant’s name:

____

Participant’s signature:

____

Date: _________________________

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Statement by Investigator

☐ I have explained the project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

If the Investigator has not had an opportunity to talk to participants prior to them participating, the following must be ticked.

☐ The participant has received the Information Sheet where my details have been provided so participants have had the opportunity to contact me prior to consenting to participate in this project.

Investigator's name:

____

Investigator's signature:

____

Appendix D: Study Instructions

Instructions before the study:

During the first part of the study you will be presented with 54 word pairs. One of the words will be an English word, the other its counterpart in Indonesian. Press SPACE BAR to continue.

Please go through the list in your own time and do your best to learn each pair. You will only have the chance to view each pair once. You will be tested on your memory of each word pair later in the study. Press SPACE bar to continue. After studying each word pair you will be asked how confident you are that you could recall the English word from each pair if presented with the Indonesian word. Press SPACE BAR to continue. Once you have made your decision and press the SPACE BAR you cannot go back.

Instructions before providing delayed JOLs:

Before beginning the testing phase of the study we would like you to tell us how confident you are that you could recall the English word when presented with the Indonesian word only. Press the SPACE BAR to begin.

Instructions before the final recall test:

The next part of the study is the testing phase. In this part of the study you will be presented with the Indonesian word from each pair and asked to RECALL the English word from the pair. Press the SPACE BAR to continue. Please use the keyboard to type your answer. If you have no idea what the English word in the pair is, leave the space blank. When you are ready to move on to the next word press the SPACE BAR to continue.

Appendix E: Word Pairs

Word Pair (Indonesian-English)	Normed Correlations	Observations
Low fluency (difficult) word pairs		
Terlambat- Late	0	6
Tinggal – Live	0	6
Perhiasan – Jewellery	0	6
Keberangka – Departure	0	7
Bagaimana – How	0	8
Sandiwara – Theatre	0	6
Angin – Wind	0	3
Pembalut – Bandage	0	7
Sungai – River	0.12	8
Sabun – Soap	0.17	6
Telur – Egg	0.17	6
Baru – New	0.17	6
Jelek – Bad	0.2	5
Basah – Wet	0.2	5
Duduk – Sit	0.25	8
Kacamata – Eyeglasses	0.25	8
Kelapa – Coconut	0.25	8
Danau – Lake	0.29	7
Medium fluency (moderate) word pairs		
Tinggi – Tall	0.33	6
Bagasi- Luggage	0.33	6
Handuk – Towel	0.38	8
Ombak – Wave	0.38	8

Debu – Dust	0.38	8
Rendah – Short	.04	5
Panas – Hot	0.43	7
Restoran – Restaurant	0.43	7
Sekolah – School	0.43	7
Jahe – Ginger	0.44	9
Besar – Big	0.5	6
Asli – Authentic	0.5	6
Coro – Cockroach	0.5	8
Sakit – Sick	0.57	7
Sutera – Silk	0.57	7
Reservasi – Reservation	0.6	5
Pesta – Party	0.6	5
Sapi – Cow	0.6	5

High fluency (easy) word pairs

Turis – Tourist	0.62	8
Fotokopi – Photocopy	0.62	8
Botol – Bottle	0.67	6
Bon – Bill	0.71	7
Telepon – Telephone	0.83	6
Guru – Teacher	0.86	7
Dokter – Doctor	0.86	7
Buku – Book	0.86	7
Gelas – Glass	0.88	8
Tekstil – Textile	0.88	8
Foto – Photograph	0.89	9
Taksi – Taxi	0.89	9
Wanita – Woman	1	6

Bis – Bus	1	7
Polisi – Police	1	8
Bir – Beer	1	8
Sama – Same	1	6
Sandel – Sandal	1	6

Appendix F: Language History Questions

1. What language do you predominantly speak at home? ______________________

2. Can you speak Indonesian fluently? YES / NO (please circle)

3. Have you ever studied Indonesian? YES / NO (please circle)

   3a. For what length of time did you study it (approx.)?

   ____

   3b. How long ago did you study it (approx.)?

   ____

Appendix G: Resolution Analyses Output

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Time	Sphericity Assumed	6.963	1	6.963	76.818	.000	.663	76.818	1.000
	Greenhouse-Geisser	6.963	1.000	6.963	76.818	.000	.663	76.818	1.000
	Huynh-Feldt	6.963	1.000	6.963	76.818	.000	.663	76.818	1.000
	Lower-bound	6.963	1.000	6.963	76.818	.000	.663	76.818	1.000
Time * TOI_Group	Sphericity Assumed	.163	1	.163	1.799	.188	.044	1.799	.258
	Greenhouse-Geisser	.163	1.000	.163	1.799	.188	.044	1.799	.258
	Huynh-Feldt	.163	1.000	.163	1.799	.188	.044	1.799	.258
	Lower-bound	.163	1.000	.163	1.799	.188	.044	1.799	.258
Error(Time)	Sphericity Assumed	3.535	39	.091					
	Greenhouse-Geisser	3.535	39.000	.091					
	Huynh-Feldt	3.535	39.000	.091					
	Lower-bound	3.535	39.000	.091					
Difficulty	Sphericity Assumed	.024	2	.012	.109	.897	.003	.218	.066
	Greenhouse-Geisser	.024	1.919	.013	.109	.890	.003	.209	.066
	Huynh-Feldt	.024	2.000	.012	.109	.897	.003	.218	.066
	Lower-bound	.024	1.000	.024	.109	.743	.003	.109	.062
Difficulty * TOI_Group	Sphericity Assumed	.882	2	.441	3.979	.023	.093	7.957	.697
	Greenhouse-Geisser	.882	1.919	.459	3.979	.024	.093	7.635	.684
	Huynh-Feldt	.882	2.000	.441	3.979	.023	.093	7.957	.697
	Lower-bound	.882	1.000	.882	3.979	.053	.093	3.979	.494
Error(Difficulty)	Sphericity Assumed	8.642	78	.111					
	Greenhouse-Geisser	8.642	74.844	.115					
	Huynh-Feldt	8.642	78.000	.111					
	Lower-bound	8.642	39.000	.222					
Time * Difficulty	Sphericity Assumed	.216	2	.108	1.090	.341	.027	2.181	.235
	Greenhouse-Geisser	.216	1.985	.109	1.090	.341	.027	2.165	.234
	Huynh-Feldt	.216	2.000	.108	1.090	.341	.027	2.181	.235
	Lower-bound	.216	1.000	.216	1.090	.303	.027	1.090	.175
Time * Difficulty * TOI_Group	Sphericity Assumed	.203	2	.101	1.025	.364	.026	2.049	.223
	Greenhouse-Geisser	.203	1.985	.102	1.025	.363	.026	2.034	.222
	Huynh-Feldt	.203	2.000	.101	1.025	.364	.026	2.049	.223
	Lower-bound	.203	1.000	.203	1.025	.318	.026	1.025	.167
Error(Time*Difficulty)	Sphericity Assumed	7.726	78	.099					
	Greenhouse-Geisser	7.726	77.430	.100					
	Huynh-Feldt	7.726	78.000	.099					
	Lower-bound	7.726	39.000	.198					

a. Computed using alpha = .05

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	17.313	1	17.313	505.030	.000	.928	505.030	1.000
TOI_Group	.073	1	.073	2.126	.153	.052	2.126	.296
Error	1.337	39	.034					

a. Computed using alpha = .05

3. Time

Measure: MEASURE_1

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.291	.028	.235	.347
2	.628	.028	.570	.685

8. TOI_Group * Time * Difficulty

Measure: MEASURE_1

TOI_Group	Time	Difficulty	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Incremental	1	1	.215	.065	.084	.347
		2	.354	.069	.214	.495
		3	.471	.073	.323	.619
	2	1	.595	.063	.468	.722
		2	.677	.060	.555	.798
		3	.625	.085	.453	.797
Entity	1	1	.274	.067	.139	.409
		2	.282	.071	.139	.426
		3	.151	.075	-.001	.303
	2	1	.732	.064	.602	.862
		2	.581	.061	.456	.705
		3	.559	.087	.383	.735

Appendix H: Study Time Analyses Output

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Difficulty	Sphericity Assumed	227376429.7	2	113688214.8	34.884	.000	.384	69.768	1.000
	Greenhouse-Geisser	227376429.7	1.289	176404316.6	34.884	.000	.384	44.963	1.000
	Huynh-Feldt	227376429.7	1.330	170975153.3	34.884	.000	.384	46.391	1.000
	Lower-bound	227376429.7	1.000	227376429.7	34.884	.000	.384	34.884	1.000
Difficulty * TOI_Group	Sphericity Assumed	14414213.90	2	7207106.949	2.211	.114	.038	4.423	.443
	Greenhouse-Geisser	14414213.90	1.289	11182907.37	2.211	.135	.038	2.850	.351
	Huynh-Feldt	14414213.90	1.330	10838733.09	2.211	.134	.038	2.941	.357
	Lower-bound	14414213.90	1.000	14414213.90	2.211	.143	.038	2.211	.309
Error(Difficulty)	Sphericity Assumed	365014351.8	112	3259056.713					
	Greenhouse-Geisser	365014351.8	72.181	5056915.292					
	Huynh-Feldt	365014351.8	74.473	4901279.539					
	Lower-bound	365014351.8	56.000	6518113.425					

a. Computed using alpha = .05

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Difficulty	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Difficulty	Level 1 vs. Level 3	441768265.4	1	441768265.4	39.067	.000	.411	39.067	1.000
	Level 2 vs. Level 3	54589840.49	1	54589840.49	15.532	.000	.217	15.532	.972
Difficulty * TOI_Group	Level 1 vs. Level 3	25931197.96	1	25931197.96	2.293	.136	.039	2.293	.319
	Level 2 vs. Level 3	1149292.600	1	1149292.600	.327	.570	.006	.327	.087
Error(Difficulty)	Level 1 vs. Level 3	633251586.6	56	11308064.05					
	Level 2 vs. Level 3	196820804.3	56	3514657.219					

a. Computed using alpha = .05

4. TOI_Group * Difficulty

Measure: MEASURE_1

TOI_Group	Difficulty	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Incremental	1	4126.485	347.076	3431.208	4821.763
	2	5391.295	614.729	4159.845	6622.746
	3	6222.664	784.482	4651.158	7794.171
Entity	1	3908.967	371.898	3163.966	4653.968
	2	6232.058	658.693	4912.538	7551.578
	3	7345.633	840.586	5661.738	9029.528

Correlations

		TOI_Score	IJOL_ST_Cor
TOI_Score	Pearson Correlation	1	-.150
	Sig. (2-tailed)		.262
	N	58	58
IJOL_ST_Cor	Pearson Correlation	-.150	1
	Sig. (2-tailed)	.262	
	N	58	58

Correlations

		TOI_Score	DJOL_ST_Cor
TOI_Score	Pearson Correlation	1	-.068
	Sig. (2-tailed)		.610
	N	58	58
DJOL_ST_Cor	Pearson Correlation	-.068	1
	Sig. (2-tailed)	.610	
	N	58	58

Appendix I: Accuracy Analyses Output

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Difficulty	Sphericity Assumed	.714	2	.357	40.108	.000	.417	80.215	1.000
	Greenhouse-Geisser	.714	1.914	.373	40.108	.000	.417	76.751	1.000
	Huynh-Feldt	.714	2.000	.357	40.108	.000	.417	80.215	1.000
	Lower-bound	.714	1.000	.714	40.108	.000	.417	40.108	1.000
Difficulty * TOI_Score	Sphericity Assumed	.004	2	.002	.197	.821	.004	.395	.080
	Greenhouse-Geisser	.004	1.914	.002	.197	.812	.004	.377	.079
	Huynh-Feldt	.004	2.000	.002	.197	.821	.004	.395	.080
	Lower-bound	.004	1.000	.004	.197	.659	.004	.197	.072
Error(Difficulty)	Sphericity Assumed	.996	112	.009					
	Greenhouse-Geisser	.996	107.163	.009					
	Huynh-Feldt	.996	112.000	.009					
	Lower-bound	.996	56.000	.018					

a. Computed using alpha = .05

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Difficulty	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Difficulty	Level 1 vs. Level 2	.818	1	.818	47.772	.000	.460	47.772	1.000
	Level 2 vs. Level 3	.050	1	.050	3.349	.073	.056	3.349	.436
Difficulty * TOI_Score	Level 1 vs. Level 2	.007	1	.007	.380	.540	.007	.380	.093
	Level 2 vs. Level 3	.004	1	.004	.241	.626	.004	.241	.077
Error(Difficulty)	Level 1 vs. Level 2	.959	56	.017					
	Level 2 vs. Level 3	.834	56	.015					

a. Computed using alpha = .05

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	.889	1	.889	88.797	.000	.613	88.797	1.000
TOI_Score	.096	1	.096	9.631	.003	.147	9.631	.862
Error	.561	56	.010					

a. Computed using alpha = .05

1. Difficulty

Measure: MEASURE_1

Difficulty	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.755 [a]	.015	.725	.785
2	.270 [a]	.018	.233	.306
3	.104 [a]	.016	.072	.137

a. Covariates appearing in the model are evaluated at the following values: TOI_Score = 33.2241.

Correlations

		TOI_Score	Accuracy
TOI_Score	Pearson Correlation	1	-.385**
	Sig. (2-tailed)		.003
	N	58	58
Accuracy	Pearson Correlation	-.385**	1
	Sig. (2-tailed)	.003	
	N	58	58

**. Correlation is significant at the 0.01 level (2-tailed).